



Pumpkin pie and various squashes.

Perfect Pumpkin Pollinators The Squash Bees!

Sweet, smooth, and spicy, it's no wonder that pumpkin pie is a holiday favorite, year after year.

But the rotund pumpkins from which the delicious pie filling is made will only form when the plants' showy, yellow-orange blossoms are pollinated.

Fortunately, native bees of the genera *Peponapis* and *Xenoglossa* are excellent pumpkin patch pollinators. Apparently, they're also proficient pollinators of pumpkin's many cucurbit relatives, including gourds and squash—spaghetti, pattypan, butternut, Hubbard, and zucchini.

ARS entomologists Jim Cane, Frank Eischen, and Blair Sampson are enthusiastic boosters of the so-called squash and gourd bees—about 20 wild, indigenous North, Central, and South American species in all.

Cane says these unobtrusive, hardworking bees are early risers—already at work

before sunrise, when squash blossoms are just beginning to open. Honey bees, bumble bees, and other pollinating insects won't begin showing up until at least half an hour later, according to Cane. He's based at the agency's Pollinating Insects Biology, Management, and Systematics Research Unit in Logan, Utah.

Squash bees' underground nests—typically tunneled a foot or so beneath the surface—are much less noticeable than the aboveground homes of other bees, he points out. That might help explain why even the people who grow pumpkins for fun or for profit may be oblivious to the busy squash bees.

Both male and female squash bees take up the blooms' sweet nectar. But only the females seek the orange pollen grains, munching on or carrying the grains and nectar back to their nests as provisions for their offspring.

Back at the pumpkin patch, the blooms will have closed by midday, and squash bees will have all but disappeared from view. The wiliest of the males will be spending the rest of their day—and night—sleeping peacefully in a flower. The next morning, these plan-ahead Romeos will be fully refreshed and ready to romance unsuspecting females that begin to arrive as soon as flowers open.

In recent studies, Cane and colleagues have provided new details about the bees' habits and prevalence. New

information suggests that these specialty bees handle a hefty share of the pumpkin, squash, and gourd pollination workload in most of the United States.

The bees' pollination skills are good news for backyard gardeners and commercial growers, especially in light of the problems plaguing America's best-known pollinator, the European honey bee, *Apis mellifera*. Honey bee colonies have been hit hard by a growing list of woes, including the mostly mysterious colony collapse disorder, as well as the troubles brought on by beetles, mites, Africanized honey bees, diseases, and pesticides.

Squash bee research by the three ARS scientists expands on pioneering studies by entomologist Vince Tepedino, now retired from the Logan lab but continuing to work with the team as a collaborator. Tepedino's investigation in a Utah zucchini field, for example, provided evidence that strong populations of squash bees such as *P. pruinosa* can handle squash-pollination assignments without help from honey bees. The wild bees would thus free up the increasingly scarce, in-demand honey bees for work elsewhere.

Cane, in a more recent study of the same squash bee species, determined that male *P. pruinosa* bees, acting alone, can successfully pollinate a large share of yellow summer squash blossoms. "That's

JIM CANE (D1275-1)



With tongue extended, a female *Peponapis* bee sips nectar from a yellow squash flower.



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unusual,” he says. “In the past, less than 10 percent of crop production has been attributed to male bees. If males do a large share of the plant pollinating, that’s a big advantage to growers and beekeepers. With both males and females on the job, you need fewer bees, overall.”

One of the factors that might explain the male *P. pruinosa* bee’s surprisingly significant role is his choice of where to patrol for females. Unlike some male bees that mainly look for females at nest sites, *P. pruinosa* males “avidly visit flowers,” says Cane.

“When they’re ‘picking up’ a female, they’re also picking up pollen—on their bodies—and taking it with them from flower to flower.”

Where the Bees Are

More insights into these bees are emanating from a far-reaching survey called “Squash Pollinators of the Americas.” Cane launched this collaboration of bee biologists, pollination ecologists, and others in North, Central, and South America in 2004. The ongoing, science-based census counts squash- and pumpkin-pollinating bees “in everything from garden plots to market gardens to large commercial farms in valleys of intensive agriculture,” says Cane. “The largest census site had nearly 1,000 contiguous acres planted to squash. Initial survey estimates suggest the site hosted at least 135,000 squash bees.”

The census is the first hemisphere-scale survey of its kind ever developed for a nonsocial (that is, not living in a hive or other colony) bee. Made possible in part by the ease of communicating via the Internet, the survey will enable collaborators to develop a science-based, statistically sound overview of the presence and pollination prowess of squash and gourd bees of the New World.

The study’s protocol, tested and fine-tuned by Cane and collaborators, has already been adapted by the Food and Agriculture Organization of the United Nations as a model for investigations of native crop-pollinating insects elsewhere.

As their time permits, participants provide data about the number and kinds of pollinators that visit squash or gourd blossoms at the selected sites. These statistically sound “snapshots” take about 10 to 20 minutes to complete and can be made anytime during the growing season, Cane says.

At the Honey Bee Research Unit in Weslaco, Texas, Frank Eischen has been collecting data for the survey for the past 3 years. Along with technician Henry Graham, Eischen is monitoring *Peponapis* and honey bees on early plantings of squash in the Rio Grande Valley of Texas.

Results from Weslaco suggest that *Peponapis* bees appear to be “far more abundant than honey bees in our plots each year,” says Eischen. “It seems evident that squash growers would want to ensure that they have ample numbers of these bees available for their crop.”

In the southeastern United States, colleague Blair Sampson scrutinized blossoms of pumpkin, crookneck, straight neck, Lakota, and zucchini squash at one of the ARS Southern Horticultural Laboratory field sites in Poplarville, Mississippi, and in nearby McNeil.

“Preliminary data from our observations—mainly of *P. pruinosa* and *X. strenua*—suggest that wild squash and gourd bees have all five of the traits ascribed to the world’s most efficient crop pollinators: They’re abundant, competitive, efficient, faithful in their choice of crop, and fast,” says Sampson.

“When you look at this information and that from the other survey sites,” says Cane, “a general picture of the squash bees’ contributions in the Americas begins to emerge.”

Among them:

- Locations that have a history of pumpkin, squash, or gourd cultivation are typically continuing to host thriving *Peponapis* populations.

- Some conventionally managed farms that use pesticides judiciously on squash or other crops nearby nonetheless have an abundance of *Peponapis* bees.

- Even in extensive plantings, populations of squash and gourd bees remain high, unlike some wild bee densities that tend to thin out as field size increases.

In all, squash and gourd bees “appear to be ubiquitous, prevalent, abundant, and efficient pollinators of squashes and gourds, from Canada to Uruguay—with the notable exception of the Pacific Northwest and the Amazon Basin,” Cane says. “If this finding continues to hold true, it would represent the first instance of an unmanaged, native, nonsocial bee playing a key role in production of an agricultural crop.”

In fact, squash bees may “prove to be the most important floral specialists in agriculture in the Americas,” he says. The squash and gourd bee studies help ensure that the needs of these talented pollinators are fully understood and met.—By **Marcia Wood**, ARS. **Alfredo Flores**, ARS, contributed to this article.

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